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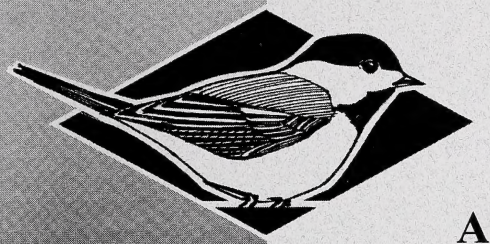

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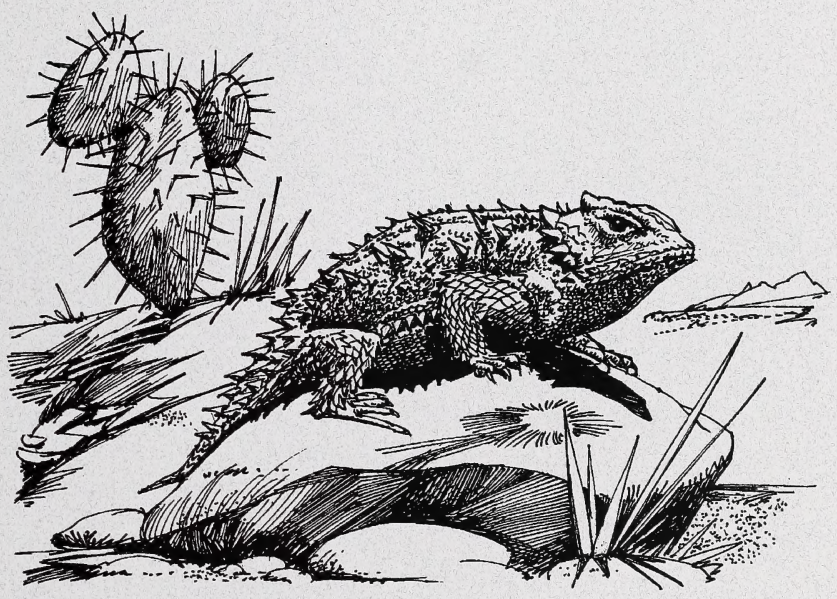

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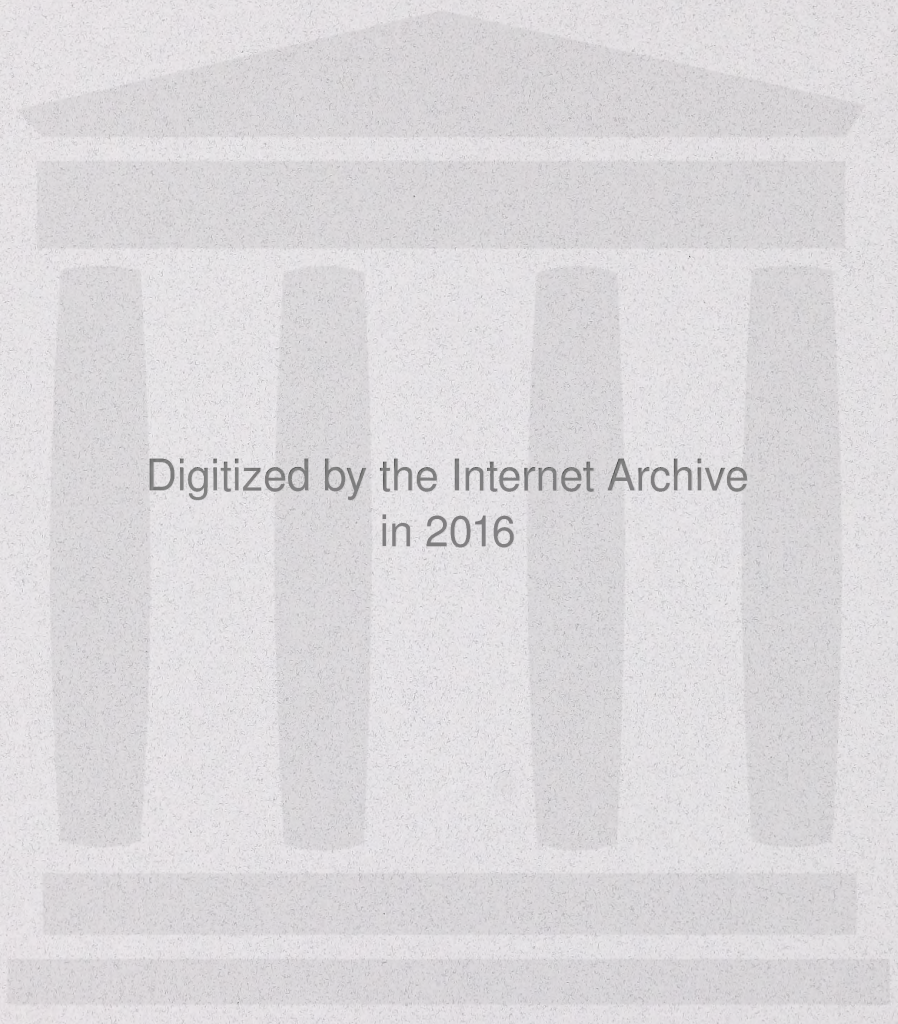
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A Survey of Short-Horned Lizard (*Phrynosoma hernandesi hernandesi*) Populations in Alberta

Janice D. James

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For copies of this report, contact:

Information Centre – Publications
Alberta Environment / Alberta Sustainable Resource Development
Main Floor, Great West Life Building
9920 108 Street
Edmonton, Alberta, Canada T5K 2M4
Telephone: (780) 422-2079

OR

Information Service
Alberta Environment / Alberta Sustainable Resource Development
#100, 3115 12 Street NE
Calgary, Alberta, Canada T2E 7J2
Telephone: (403) 297-3362

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DISCLAIMER

The views and opinions expressed are those of the author(s) and do not necessarily represent the policies or positions of the Department or the Alberta Government.

EXECUTIVE SUMMARY

Short-horned lizards occupy a number of relatively isolated, widely scattered localities within southeastern Alberta. Populations of these small, well-camouflaged lizards are generally of low density and overall abundance in Alberta, due to provincial populations being at the northernmost margin of the species' range in North America. The species is classified as "May be at Risk" in Alberta due to the small number of isolated populations. The genus to which this species belongs has recently undergone a taxonomical re-evaluation based on genetic information. The name of the sub-species has been changed to *Phrynosoma hernandesi hernandesi*, to reflect these recent findings. The truncated common name of "Short-horned lizard" will be used until current disagreements in the literature regarding the proper common name usage for each subspecies have been resolved.

The objectives of this year's survey were to search all historically recorded locations for the species in the province, to evaluate the probability of continued persistence, given the habitat currently available, and to determine the continued presence of the species by captures where possible. Over the course of the survey, 125 individual lizards were captured. Within those sites found to be occupied by lizards, the average density of captures was calculated to be approximately two animals per hectare, although southern sites were generally more populous than northern sites.

In total, 43 separate sections of land were searched, either completely or in part. Lizards were not found in some previously well-occupied sites, which is a source of concern for the persistence of these populations. There is concern over the quality of location data available from the provincial BSOD database. This issue requires immediate attention if quality information is to be available to researchers. It is also significant, as it may have an important impact on the status of the species by affecting the total number of known locations. Survey efforts in the field season of 2001 were not able to include a number of sites and it is hoped to continue the effort in the summer of 2002 to complete the evaluation of the current distribution within the province.

1.0 INTRODUCTION

Horned lizards are small, unusual lizards endemic to western North America. Often more popularly recognized as "horny toads", their rounded, flattened profile does indeed lend them a toad-like body resemblance and gait. However, they are true reptiles and exhibit all of the appropriate traits, including scaly skin and amniotic eggs. As such, they are highly adapted to the dry, hot conditions of the arid regions they inhabit. Sharp, pointed horns on the backs of their heads and along the sides of their bodies, combined with excellent camouflage, are their main defenses against potential predators.

The extreme southeastern corner of Alberta is home to a restricted number of scattered and apparently isolated populations of Short-horned lizards (*Phrynosoma hernandesi hernandesi*). Short-horned lizards are one of a number of Great Plains species, such as Sage grouse (*Centrocercus urophasianus urophasianus*), Prairie rattlesnakes (*Crotalus viridis),* and Ord's Kangaroo Rat (*Dipodomys ordii*), that are at the most northerly extensions of their ranges in the southeastern corner of Alberta. Such peripheral populations are significant to species because they often harbour significant genetic variation that may not occur in the rest of the species. As such, these marginal populations are hypothesized to be critical in the evolutionary process by supplying the genetic variability required when environmental disruptions force species to adapt. Short-horned lizards are the most northerly-ranging species within the Family Phrynosomatidae. They are the only native lizard species found in Alberta, and one of only a very few lizard species, globally, able to live at such high latitudes and under such extreme climatic conditions.

Figure 1: Distribution of Short-horned lizards (*Phrynosoma hernandesi*) in North America.

Based on Conant (1975) and Stebbins (1985) with revisions derived from Russell and Bauer (2000).

As there are a limited number of recorded population locations in Alberta, and the populations within those sites appear to be small and of low density, it is imperative that the species be monitored periodically to evaluate the status of the species and to ensure that human actions do not deleteriously impact these unique members of our prairie landscape. The last effort to determine the range and assess the general population of Short-horned lizards in Alberta was done was ten years ago, in 1991 (Powell and Russell 1992a). Recurring monitoring efforts should help to more effectively evaluate the status of the species in the province, to enable management planning where required, and ensure the

persistence of the species in Alberta. However, the low density and scattered nature of populations, combined with extremely effective camouflage and a tendency to remain motionless, makes it extremely difficult to accurately assess overall population trends. It is also important that monitoring of this species continue, especially as the degree of development within the species range expands. Other species of horned lizards have been negatively affected by habitat degradation and fragmentation in several areas of the United States (Fair and Henke 1997, Beauchamp et al. 1998, Suarez et al. 2000).

The objectives of this survey were to visit all previously reported (i.e. historical) population locations and to assess the habitat, the continued presence of the species, and population levels, if feasible. Specifically, the immediate objective was to capture as many individual lizards as possible at as many sites as could be reasonably searched by the field searchers available, within the given time frame. It was anticipated that this would enable a general comparison with past information and provide a baseline for future assessments. It will also provide information for a more accurate revision of provincial status through an updated evaluation of distribution and abundance.

Short-horned lizards are one of several species of horned lizards found in North America. This particular species is more adapted to cooler climates and higher elevations than most other species of horned lizards (Montanucci 1981, Sherbrooke 1981) and exhibits the widest distribution of all horned lizard species, ranging from southern Canada to north-central Mexico (Stebbins 1985, Russell and Bauer 1993, 2000). Short-horned lizards, as the name implies, have relatively short "horns", or spines, on the back of their heads when compared with other species of horned lizards. They have a snub-nosed profile and rather short legs for their squat bodies (Plate 1). Most species of horned lizards are "sit-and-wait" predators that eat primarily ants and have specialized teeth and digestive system to aid in the digestion of this relatively low nutrition food source (Pianka and Parker 1975).

Short-horned lizards have been relatively well-studied in Alberta since the late 1970s. Several documents record biology, ecology, and status proposals for Alberta populations (James 1997, James et al. 1997, Powell 1982, Powell and Russell 1984, 1985a, 1985b, 1991a, 1991b, 1992a, 1992b, 1993a, 1993b, 1996a, 1996b, 1996c, 1998). Like other horned lizards, Short-horned lizards in Alberta feed principally on ants, but are also somewhat opportunistic, darting out to catch unobservant beetles, grasshoppers and the occasional spider, as they happen nearby (Powell and Russell 1984). There is a marked sexual dimorphism present in Alberta populations, with males being approximately half the size of females (Powell and Russell 1985b). Even as adults, Short-horned lizards in Alberta are not large. Females average a snout-vent length (SVL) of about 70 mm and weigh about 18 g. Males weigh approximately 10 g and average around 50 mm SVL (Powell and Russell 1985a, 1993a). It is suspected they may have specialized physiological adaptations to enable them to hibernate successfully, as they merely burrow a few centimeters (7-10 cm) into the soil of protected slopes to overwinter (James 1997; Powell and Russell 1994, 1996b). Their primary predators probably include wandering garter snakes (James 1997), northern harriers (James 1997), and perhaps mammals such as grasshopper mice (Sherbrooke 1991).

Plate 1: An adult female Short-horned lizard from southeastern Alberta.

Photo by Janice James.

In Alberta, the active period for Short-horned lizards spans from emergence in mid-to late April until they begin to seek hibernaculae in mid-September (James 1997, Laird and Leech 1980, Powell and Russell 1994, 1996b). They may remain moderately active within the overwintering area into late October or early November, likely dependent upon weather conditions (James 1997, Powell and Russell 1991b, 1992a, 1993a). Mating occurs in mid to late May (James 1997). The females bear live young (viviparous) with one clutch per year being produced in late July to early August (Powell and Russell 1991a). While gravid, females may double their body weight, eventually producing 6 to 11 neonates (young), each weighing about one gram and measuring around 24 mm SVL (James 1997; Powell and Russell 1991a). The neonates grow quickly, gaining size rapidly in their first year. Males and females have similar growth rates until their second year, whereupon males cease growing, while females continue to grow (Powell and Russell 1985b). Females attain sexual maturity in their second year and are estimated to have a life span of approximately five years (Powell and Russell 1985b, 1991a).

1.1. Status History

The status of Short-horned lizards in Alberta was last reviewed by Alberta Natural Resources in 1997 (James et al. 1997). At that time, the species was recognized as *Phrynosoma douglassii brevirostre* or the "Eastern Short-horned lizard" – one of a number of subspecies of Short-horned lizards (Reeve 1952, Russell and Bauer 1993). Since then, mitochondrial DNA (mtDNA) genetic analysis of Short-horned lizards throughout the range of the species, including Alberta population samples, has been completed. From this information, only the populations found in the Columbia River drainage (Pacific Northwest) are now known as *Phrynosoma douglasii* (Crowther et al. 2000, Zamudio et al. 1997). Due to these findings, all populations of Short-horned lizards south and east of the Rockies and those in the Great Basin and Colorado Plateau regions were reclassified as *Phrynosoma hernandezi* (Zamudio et al. 1997). This includes the populations located in Alberta and Saskatchewan. The spelling of '*hernandezi*' was later contested by Smith et al. (1999) and currently the proper spelling of the name stands as '*hernandesi*'. The subspecific designation was further

determined to be *Phrynosoma hernandesi hernandesi* (Crowther 2000) and this includes those populations found in Alberta. Therefore, the scientific name used herein, *Phyrnosoma hernandesi hernandesi*, reflects these recent modifications. Subsequently, there has been some confusion over the proper common name for the species. Russell and Bauer (2000) term the species as "Mountain Short-horned lizard" whereas Crowther (2000) designates it as "Greater Short-horned lizard". Given this uncertainty it was decided to simply use "Short-horned lizard" to refer to the species for now.

Currently, the Alberta government general status report classifies Short-horned lizards in the "May Be At Risk" category, meaning "Any species that "May Be At Risk" of extinction or extirpation, and is therefore a candidate for detailed risk assessment." (Anon. 2000). In 1996 the provincial categorization for Short-horned lizards in Alberta was as "blue-listed"; meaning the species "may be at risk due to non-cyclical population declines, or reductions in habitat or provincial distribution" (Alberta Wildlife Management Division 1996). A 1992 Committee on the Status of Endangered Wildlife in Canada (COSEWIC) report categorized Short-horned lizards on the prairies as "vulnerable" (Anon. 1994, Powell and Russell 1992b). Prior to this assessment, the species was grouped as "red-listed" and "rare and localized" by Alberta Fish and Wildlife (1991). In 1985 Short-horned lizards were listed as "species considered peripheral" by Alberta Fish and Wildlife (1985). The 1984 provincial review of fish and wildlife resources listed Short-horned lizards as "threatened" in Alberta (Alberta Fish and Wildlife 1984). Short-horned lizards are fully protected under the Alberta Wildlife Act of March 1991.

To date, no comprehensive management plan has been completed for Short-horned lizards in Alberta. Management has generally consisted of a "hands-off" approach, with the information that has been collected used to develop very general guidelines for setback distances for oil and gas developments (ABSRD 2001) and broad-based educational information. There is an immense amount of oil and gas activity within the range of the species in the province. There is concern that a lack of detailed information on the species could possibly lead to damage or loss of a population or populations if their exact locations are not well documented. Continued surveys of Short-horned lizard populations promote awareness of population persistence, and should help to assess the effects of human impacts within the species' habitat.

2.0 STUDY AREA

In Canada, Short-horned lizards occupy scattered localities in the southeastern corner of the province of Alberta, and the southwestern region of Saskatchewan. In Saskatchewan they are found specifically in the region of Grasslands National Park (Powell, Russell and Fargey 1997). Another subspecies of Short-horned lizard, *Phrynosoma douglasii douglasii*, or the Pygmy Short-horned lizard, was previously recorded in south-central British Columbia, but this population is now officially designated as "extirpated" by COSEWIC (Powell and Russell 1992b). In Alberta, Short-horned lizards may be found in apparently localized populations scattered along the major topographical relief associated with watercourses or badland regions. Specifically, they tend to inhabit localized areas with thinly vegetated slopes with southern aspects located along rivers and other major topographic features within

the region. Generally, populations have been recorded in the areas near the urban centres of Medicine Hat, Bow Island, Manyberries, and Foremost.

Short-horned lizards inhabit the "dry mixed-grass prairie ecoregion" (Achuff 1992; AEP 1997; Alberta Environment 1999), situated in the southeastern corner of Alberta. Climatically, this area may be one of the more extreme in southern Canada. It is a typically continental climate, with cold winters, warm summers and low precipitation (Anon. 1993, AEP 1997). Wide temperature fluctuations, both daily and seasonally, are common. Persistent winds ensure dry conditions. Grasses are the dominant vegetation type throughout the prairie region for these reasons.

"Mixedgrass" refers to the mix of mid- and short height grasses that naturally inhabit the area (AEP 1997). Common mid-height grass species include spear grass (*Stipa* spp.), western wheat grass (*Agropyron smithii*) and June grass (*Koeleria micrantha*) with the main short-grass species being Blue grama (*Bouteloua gracilis*). The most widespread vegetation is a *Stipa comata – Bouteloua gracilis* (spear grass – blue grama grass) community with western wheat grass (*Agropyron smithii*) and northern wheat grass (*A. dasystachyum*) more significant in hummocky moraine areas (AEP 1997). Most of the soils in the dry mixed grass subregion are dark brown chernozems (ANHIC 1999, AEP 1997)

The study area for this survey included all historically recorded localities for the species in Alberta, or approximately 28 different sites (James et al. 1997). A "site" was considered an isolated section of land or several sections within the vicinity of one another. These sites consist of multiple locations along the South Saskatchewan River, Forty-Mile / Chin Coulee areas, the Manyberries area, and along the Milk River drainage (James et al. 1997). Powell and Russell (1992a) had previously classified these areas into three broadly similar habitat types occupied by Short-horned lizards in Alberta, which correspond approximately with the divisions noted by James et al. (1997). Powell and Russell (1992a) grouped sites in the region as: those along the Milk River and its tributaries; those within the Bearpaw "juniper-dunes" habitat type associated with the southern fringe of the Cypress Hills; and those sites within the "North Marginal Habitat" type around the Chin and Forty-Mile Coulees, and along the South Saskatchewan river.

In the Milk River drainage sites Powell and Russell (1992a) noted phrynosomes were most commonly encountered occupying the ecotone between the coulee sides and grasslands above, although reports of them being found in coulee bottoms and in open grassland areas were noted. The vegetation within this region is also categorized as belonging to both the mixed prairie ecoregion and the dry mixed prairie ecoregion (Achuff 1992, Alberta Environment 1999). Soils on coulee slopes are generally compact and not friable (Powell and Russell 1992a).

The "Bearpaw" habitat type is characterized by the exposure and consequent erosion of the underlying Bearpaw shale (Powell and Russell 1992a). The shale crumbles to become a substrate that supports substantial mats of creeping juniper (*Juniperus horizontalis*), interspersed with exposed stretches of windblown, thin soil. This gives the habitat a rolling, "dune-like" appearance, and likely provides ample microhabitat opportunities for Short-

horned lizards. This habitat type was decidedly the most densely populated with lizards in both Powell and Russell's (1992a) study and in this year's survey. It is also extensively fraught with oil and gas development and slated for a great deal of further expansion of such development in the near future (2002).

The "North Marginal Habitat" type, as described by Powell and Russell (1992a) is comprised primarily of the ecotone between grasslands above and coulees below, and is associated with the major drainages of the area: Chin- and Forty-Mile Coulees, and along the South Saskatchewan river. In this habitat type, Short-horned lizards are found mainly on southerly facing, thinly vegetated upper slopes of the coulees associated with these major drainages. The soil of the coulee slopes is often pocked with rocks, sandy and friable. The populations in this area seem more scattered and smaller in size, probably related to their location at the most northerly extreme of the range for the species (Powell and Russell 1992a). Oil and gas development on some sites is extensive.

3.0 METHODS

Short-horned lizards are notoriously difficult to find. Their reliance on camouflage as a method of predator avoidance is extremely effective. They are generally only visible once they move, which is often only when flushed. To make matters worse for Albertan herpetologists, even where populations exist here they are of relatively low density, and therefore lizards are seldom seen. This is particularly true of the most northern populations, which occur along the South Saskatchewan River drainage. The sparse numbers of some Alberta populations is probably related to surviving at the most northern fringe of the species range and the marginal environmental conditions encountered within that area.

Any method of searching for and estimating population levels of this species, especially over the scattered and widespread range they inhabit across the southeastern corner of the province, must take into account both these low densities and the difficulty of locating these small, cryptic animals. As they often have relatively small home ranges, they are not generally trappable. They leave little noticeable trace of their presence by way of scat or tracks. Generally, the most effective method to locate individual lizards is to walk around within suitable habitat, in areas they have been reported from in the past, during appropriate weather, and try to flush them. It is worth noting that this sounds easy in theory, but once a searcher has actually set off in pursuit of these animals, the sheer size of the task becomes very evident. The potential area of habitat to be searched is enormous when compared with the tiny size of the lizards themselves. The amount of time required to adequately check an area by foot is substantial.

With this in mind, it was considered most efficient to search for presence of these lizards in areas of previously recorded observations. The timing of the survey, during the last weeks of July and the first few weeks in August, was intended to immediately follow the parturition period (when females give birth to their young) and therefore coincide with the highest lizard population of the year. Neonates, although tiny (~24 mm SVL), are perhaps more apt to flush when approached, and therefore are conceivably more easily located than are adults. With a high number of sites to search, and limited manpower within which to do so, it

seemed prudent to restrict the search to the time period during which the probability of locating individuals was highest. This strategy was anticipated to present researchers with the highest probability possible for locating animals.

From the abundance of neonates detected, some measure of the adult population may be inferred; the number of neonates was expected to reflect the number of reproductive adults, and therefore, the robustness of the population itself. Female Short-horned lizards in Alberta may give birth to six to 11 neonates per year (Powell and Russell 1991a). The location of high numbers of neonates immediately following the parturition period may suggest a successful and robust population level in a given area. Conversely, low neonate numbers may suggest a low population level or poor reproductive conditions.

The time period during which such an intense survey is conducted must be limited, owing to two factors. Firstly, not all neonates will be born on exactly the same day, and therefore care must be taken to begin the study at a late enough date to include as many clutches as possible. Secondly, as time passes, a percentage of neonates will succumb to predators. It is therefore necessary to spend as many person-hours as possible within the few weeks when they are most abundant in order to gain the most accurate population information.

Before field biologists went out to search for Short-horned lizards, all participated in a one-day training session on July 23, 2001. The session was comprised of a morning of information presentations on the biology and ecology of the species in Alberta, followed by an afternoon of searching in the field for lizards at the Bow Island site on the Laidlaw Ranch. The search proved successful in that three lizards, two females and a male, were captured. This experience enabled participants to see the size and colouration of the lizards, and the type of habitat they may be found in. It also enabled them to feel more comfortable at sexing adults. No neonates were located on that date.

Searchers worked in pairs where possible. The search technique consists of walking slowly, back and forth across appropriate habitat, with each pass being about one metre from the last path taken. Searchers generally walked side-by-side about two metres apart. The technique enables each searcher to cover a two metre wide swath of habitat with each pass. Efforts were made to avoid covering area that had previously been searched. Searchers were advised to use a walking stick to probe clumps of vegetation, to keep their eyes constantly on the ground, and to pay attention to the slightest of movements, especially within their peripheral vision. Working in pairs is safer, in case of accidents, and it speeds the data recording process, and helps to prevent the onset of frustration and fatigue when few or no lizards are encountered for long periods.

Information on all lizards encountered was collected, and each animal was temporarily marked with a non-toxic felt-tipped pen, to avoid re-counting the same individuals accidentally. The exact location of all individuals was recorded using GPS receivers in NAD83 format (12U/UTM). The sex, weight, and snout-vent length (SVL) of all individuals was recorded. Males may be differentiated from females by the femoral pores in mature individuals and by enlarged post-anal scales at all ages (Powell and Russell 1985b). Vegetation information was noted regarding the 1 m^2 surrounding the initial location of

captured individuals, as well as slope and aspect of the capture site, and a general vegetation description of the 10 m^2 surrounding the capture site. General weather conditions at the time of capture were noted, as were general seasonal conditions, and estimates of daily high and low temperatures on search days. The names and phone numbers of contact individuals for access were logged, as was information about the interaction that occurred between field biologists and the landowners. The approximate area searched within each site was marked on 1:50,000 topographic maps or on air photos. The time spent searching was also recorded. Any unusual observations were also noted, and if appropriate, locations logged. For example, the GPS locations of rattlesnake rookeries were recorded. Lastly, photos were taken of most locations to provide a visual record of sites, whether or not lizards were captured at the site and the GPS location of those photo points recorded.

4.0 RESULTS

All original data, on paper, has been stored in the Medicine Hat office of Alberta Sustainable Resource Development by Joel Nicholson. The digitized form of the same raw data, photos included, has been maintained on CD-ROM and made available to both the Lethbridge and Medicine Hat offices, as well as to the headquarters in Edmonton, for long-term reference. Data was input into Microsoft Excel 2000 and text into Microsoft Word 2000. All capture data was input into the Biodiversity Species Observation Database (BSOD) to facilitate future management efforts. Photos and maps were digitally saved in .jpg format. All topographic maps used were 1:50,000 Canada Centre for Mapping, Department of Energy, Mines and Resources maps. The mapsheet numbers of the maps used is recorded in the Excel data file. The author maintains exclusive copyright of any digitized photos and information used in the educational presentation given on July 23, 2001.

Statistically, the information collected is likely most useful when used strictly as descriptive. We had hoped to be able to derive some form of index from the data gathered and thus be able to give a rough estimate of population in the sites searched. However, information from such a relatively rare and difficult to locate species is not well suited to rigorous statistical analysis (Thompson et al. 1998). As well, Thompson et al. (1998: 253) point out "…index information will only provide, at best, a rough guess at population trends, and should not be relied upon for monitoring species of special concern." Considering this, it was decided to evaluate the data in a descriptive manner only.

Overall, the locations and data from 125 individual Short-horned lizards were recorded. As well, one position was recorded for a confirmed location of a previous sighting by biologists working on a separate study (Yucca plants). Field biologists spent a total of 159 hours, seven minutes working concurrently. This only considers the total time spent in the field. It must be noted that when lizards were captured, the collection of data from each individual animal took about 10 minutes per capture. Therefore, the time taken for the recording of data from all animals was subtracted from the total time spent searching, leaving an adjusted total of 138 hours, 17 minutes spent actually searching. Thus, the total number of man-hours spent searching (total adjusted time searched X # searchers) was calculated to be 291 hours, 34 minutes. As a result, the average time actually spent searching per lizard capture was approximately two hours, 20 minutes of searching (=291:34 / 125). Larry Powell suggested

that in his experience he allotted approximately three hours per lizard capture, which includes about 20-25 minutes spent collecting data per capture (pers. comm.), so our success rate was relatively similar to those of past efforts. If only the sites at which lizards were actually found are considered, then the search time dropped noticeably to 1 hour 45 minutes per lizard captured.

An estimate of the area searched may be projected from the time spent searching. Based on information from a GPS recorder, the average walking speed while searching was around 2.1-2.2 km/h. If the more conservative value of 2.1 km/h is used, it can thus be estimated that each searcher, searching a two metre wide swath, and covering around 2100 m per hour, was searching about 4200 m^2 of area per hour, or 70 m^2 per minute. Therefore, approximately 1,224,545 m^2 (or 122.45 ha) of habitat were searched in total, or 9796 m^2 (0.9796 ha) or about one hectare for each lizard actually found. An average of 30614 m^2 (3.0614 ha) were searched per site, whether or not lizards were found. Of course, there was a great deal of variation among individual sites (range: 5600 m^2 – 75600 m^2). If only the sites where lizards were actually located are considered, the density of lizards captured was one per 4798 m^2 or about two lizards per hectare searched. Potential sources of error include time recorded as searching, while not doing so, and the difference in walking speed of individual searchers.

Forty-three separate sections of land (section-township-range-west of meridian) were searched, either entirely or in part, between July 23 and August 23, 2001 by the field biologists involved. Searches were conducted on 19 separate days within that time frame. Of the historically recorded locations, a number of those sites visited this summer are likely to have been extirpated; especially those in cultivated or otherwise radically altered habitat areas.

There were up to 36 additional sections of land that are purported to harbour Short-horned lizard populations, but which were not searched this summer. However, the majority of these locations were taken from the BSOD database, and some of them may have a level of dithering incorporated into them, as some did not correspond exactly with well-known sites. In general, we tried to ground search BSOD recorded land locations if they were near our traditionally recorded sites, but we did not go out of our way to incorporate all of them. Generally, they were within the vicinity (often adjacent sections) of the traditionally recorded sites. There were therefore 30 remaining sections of land that we would have liked to have searched, but did not manage to in the 2001 field season.

The summer of 2001 was one of the ten driest ever recorded in southern Alberta (Anon. 2001). Drought conditions prevailed across the entire study area, though moisture levels varied conspicuously from region to region. Some areas were so dry that there was no vegetative growth at all this year, and ranchers maintained their herds in smaller areas where they would not cause further damage to the rangelands, or else sold them off. During the study period one major shower (~5 cm) occurred (July 31) in the Medicine Hat, Manyberries Hills, and Writing-on-Stone areas, but did not amount to much in the areas along the South Saskatchewan river to the west of Medicine Hat (<2 cm).

In total, 36 male, 49 female, and 40 juvenile lizards were captured during the survey. No animals were recaptured. This lack of recaptures is chiefly due to the search patterns used by field biologists, as they actively attempted to cover an area, rather than go back over the same ground, if possible. It is not expected that this is an indication population size, as that (capture: recapture technique) was not the intent of the survey method. Neonates (juveniles) were not identified to sex. The average, maximum and minimum values for SVL and weight for males, females and neonates is summarized below in Table 1.

MALES (n=36)	Average	Maximum	Minimum
SVL (mm)	43.64	50	39
Weight (g)	6.93	10	5
FEMALES (n=49)			
SVL (mm)	55.12	74	43.5
Weight (g)	13.18	29.5	8
NEONATES (n=40)			
SVL (mm)	23.94	25.5	21
Weight (g)	1.28	1.85	1

Table 1: SVL and weight of male, female, and neonate Short-horned lizards captured.

Short-horned lizards in Alberta appear to be habitat generalists to a certain extent. This is not surprising, since Short-horned lizards have been found to occupy a wide variety of habitat types across the range of the species (Montanucci 1981). The requirements for habitat in Alberta also seem relatively broad: sparsely vegetated southerly facing slopes, relatively friable soils, adequate environmental heat and enough prey to fuel survival and reproduction.

Topographically, the generalization that Short-horned lizards are primarily found on moderate slopes with southern exposures appeared to hold. In this survey, lizards were mainly captured on slopes facing south (22.5%), southeast (25.8%), or southwest (22.5%) for a total of southern exposures of 70.8%. Captures were also made on slopes facing east (16.6%), west (5.8%), and north (4.2%), as well as northwest (2.5%). No captures were made on slopes with northeastern aspects. Neonates frequented the steepest slopes, with the average being 21.5%. Adult females and males were captured on more moderate slopes, averaging 15.96% and 17.03% respectively. Elevation of captures ranged from a low of 715 m at the Laidlaw Ranch (one of the more northerly sites) to a high of 1155 m in the Manyberries Hills (one of the more southerly sites) – a difference of 440 m. The elevation of the sites along the South Saskatchewan were between 715-785 m, and those in the Manyberries Hills were between 980 and 1155 m. Data from other localities was not available.

Short-horned lizards in Alberta seem to be more influenced by habitat structure than vegetative species composition. They require a relatively open soil surface, with some cover, either by way of shrubs, which seemed more significant to adults, or grasses, which appeared to suffice for neonates. The actual species of shrubs or grasses varied a great deal between captures and among sites. Summaries for each category are documented in Table 2 below. The average value for the percentage of open soil within the one square metre surrounding

the site of lizard captures was remarkably similar among all classes. The overall average of open soil was 51.93% with a median of 55% and mode of 60%; females averaged 50.35%, males averaged 52.69% and neonates averaged 53.13%. The variation between individual capture sites was wide, ranging from 85% to 0% of the substrate in the "open soil" category. Although soil samples were not collected, observations indicated that soils in the northern marginal habitat and the Juniper dunes areas were generally more sandy and friable than those found in the Milk River drainage habitat area.

The remaining significant habitat categories included "shrub" and "grass" cover. The remaining categories of "rock", "forbs" and "other" were the least common. Shrub species consisted primarily of sagebrush (*Artemesia cana*) and creeping juniper (*Juniperus horizontalis*), although skunkbush (*Rhus trilobata*), greasewood (*Sarcobatus vermiculatus*), and rabbit brush (*Chrysothamnus nauseosus*) also occurred. Shrub cover averaged 21.54% and grass cover averaged 19.28% for all captures. Overall, the percentage of shrubs in the plots wherein adults were captured were very similar; averaging 25.76% and 25.14% for females and males respectively. Grass cover in the capture plots for adults was 17.02% and 13.33% for females and males, in that order. For neonates however, shrub cover averaged only 13.13%, much lower than for adult classes. Grass cover in neonate capture locations was 27.40%, much higher than adult classes. In all cases the range of results was wide; shrubs varied from comprising 0 to 90% of cover, while grasses ranged from 0 to 70% of available cover.

	Grass	Forbes	Shrubs	Open Soil	Rock
All Captures Average (N=125):	19.28	2.67	21.54	51.55	6.30
Max:	70.00	30.00	90.00	85.00	75.00
Min:	0.00	0.00	0.00	0.00	0.00
Ave Female (n=49):	17.02	2.97	25.76	49.43	6.71
Max:	70.00	30.00	90.00	85.00	75.00
Min:	0.00	0.00	0.00	5.00	0.00
Ave Male (n=36):	13.33	1.45	25.14	52.69	5.85
Max:	50.00	10.00	60.00	85.00	40.00
Min:	1.00	0.00	0.00	0.00	0.00
Ave Juvenile (n=40):	27.40	3.33	13.13	53.13	6.18
Max:	60.00	30.00	45.00	80.00	35.00
Min:	0.00	0.00	0.00	0.00	0.00

Table 2: Percentage of cover types within 1 m^2 of lizards captures.

It is the ardent recommendation of the author that the information we have gathered on exact locations of individual animals be strictly guarded from any public use. This information is highly sensitive in three ways. Firstly, individual animals do not range widely, and the information is so specific in some cases as to potentially render these individuals susceptible to capture by unscrupulous collectors or even malicious individuals bent on eradication. Secondly, out of respect for the confidentiality of those landowners who so graciously permitted our research, it is imperative that specific information about sensitive species on

their land not be made widely available. Lastly, this survey represents a definitive summary of all recorded locations of this species in the province. The potential for such information to provide a negative outcome for the species in the province must be carefully weighted against the positives of our enhanced understanding of it.

With the latter in mind, it is suggested that the information be "hazed" to within one mile, or one section, of the actual locations for individual lizards found. Such scrambled information could be made available to outside interests, such as environmental impact assessments for oil and gas interests. Conversely, within the government offices themselves it is very important that the information be made available in as accurate a format as possible, especially given some of the apparently jumbled "confidential" information provided to the survey effort this year by some of the BSOD records. If further surveys are to be conducted, it is essential that this original information be directly available to facilitate the precision of replication in any long-term monitoring of these populations.

Sites searched were grouped together into three broadly related regions: along the South Saskatchewan River valley and affiliated with Chin or Forty-Mile Coulees, within the Manyberries Hills area, and along the Milk River valley and associated drainages. Each area exhibited broadly applicable topographic and vegetative features, some of which were not present in other regions.

4.1. Sites along the South Saskatchewan River and Forty-Mile Coulee drainages

Most of the population sites investigated in this region were along the banks or directly associated drainages of the South Saskatchewan River proper (Plate 2). The majority of sites are located on large ranches; however, some are remnant patches within urban or cultivated areas. The sites within the urban limits of Medicine Hat and Redcliff were not searched this year, as we left the most accessible sites to the last, and then ran out of time and manpower. One anecdotal report may extend the most northern range of the species along the east side of the river by perhaps a mile or more.

Sites along both Forty-Mile and Chin Coulees were also investigated. The vegetation in these areas was similar to that found at sites along the river, with grassy spurs sinking towards the coulee valleys, and being covered in sparse grasses, scattered sage, cacti, and at lower elevations, greasewood bushes. Soils are friable. Captures in these sites are relatively infrequent when compared with some of the sites further south, and populations here are considered to be of low density, likely related to their north-marginal situation.

4.2. Sites in the vicinity of the Manyberries Hills

Most sites within this area are on two ranches. The sites in this area were the most densely populated of all those searched this summer. Some searchers actually complained, jokingly, that it took them so long to cover some sites because there were so many lizards to collect data from that it took longer to search than at other locations. Perhaps partly for this reason, several sites in this region were not searched. Since there were a limited number of these sites it would be prudent to attempt to search them next summer (2002) to complete the survey.

Within these sites, eroded Bearpaw shale comprises most of the substrate in lower areas, with hummocks of grassland standing above (Plate 3). The soil derived from the shale is crumbly and friable, with little vegetation, except for mats of creeping juniper, to keep it from washing or blowing away. Lizards were captured within the juniper dunes areas (Plate 3 & 4), on the grassland above and on the ecotonal slopes in between.

4.3. Sites along the Milk River and associated drainages

This area includes site at Onefour, the Milk River Natural Area, and along the Lost River valley (Plates 5-7). Some of the sites in this area were classified by Powell and Russell (1992) as being the most populous in the province. Several sites within this area were not surveyed this summer; again, it would serve well to try to do so in 2002.

These are the most southerly of the sites within the province. The Milk River is a tributary of the Missouri / Mississippi River system, and is the only river in the province with this distinction. South of the Milk river, the vegetation is classified as being "mixed grass" instead of belonging to the "dry mixed grass subregion" (Achuff 1992). All locations are associated with the Milk River or its tributaries, and are within a relatively short distance of the US border. The vegetation in this area is more similar to that in the North Marginal habitat area than to the nearby Manyberries Hills area; however, the soils seem generally less friable than in either of the other locations.

Plate 2: Bow Island site along the South Saskatchewan River (pictured at centre) – North marginal habitat type. July 24, 2001.

Photo by Janice James

Plate 3: Manyberries Hills – capture site in juniper dunes habitat type. August 3, 2001.

Note the dark mats of juniper on the lowlands, and the grassy hummocks above. Left to right: Dale Eslinger, Ben McWilliams and Corey Skiftun. Photo by Joel Nicholson.

Plate 4: Lost River Valley site – part of the Milk River drainage area. July 25, 2001. Photo by Joel Nicholson.

Plate 5: Milk River Natural Area (Comrey) site. August 1, 2001. Photo by Richard Quinlan.

5.0 DISCUSSION

The capture of 125 Short-horned lizards in 19 days must be viewed as successful. The technique used, that of compressing the survey period, yet increasing the number of searchers, worked reasonably well. In terms of effectiveness (total captures) this survey was comparable or perhaps even a bit more efficient than past efforts (i.e. Powell and Russell 1992a). This was considered positive, since past efforts have taken place over a much more protracted time period (3-4 months) although under less appropriate weather conditions. The average time spent per lizard capture (2:20) was somewhat less than the general average which Powell (pers. comm.) suggested was the norm for the last survey. Based on this, it is surmised that, in general, the lizard populations surveyed would seem to be approximately stable.

However, there are a number of sites that remain to be surveyed, especially those within and around the City of Medicine Hat, along the Milk River drainage, and in the Manyberries Hills area. As well, some important deviations from previous efforts were evident. For example, the search effort at several sites, including some of which had previously yielded respectable numbers of lizards, was unsuccessful. This lack of population detection in previously inhabited sites is of concern, and additional efforts should be put into investigating those sites again. For example, the Comrey site, within the Milk River Natural Area, was previously noted as being one of the most populous of all sites (Powell and Russell, 1992a), yet no animals were found there in this year's survey. Additionally, the most northerly site, on the Mitchell Ranch north of Medicine Hat, yielded no animals, in spite of good searching conditions and recently recorded captures (1997). It must be stated that just because lizards were not found, it does not mean they were absent from the surveyed area. The notorious difficulty of locating these creatures seems to vary a great deal from day to day, and from individual to individual.

The number of females captured exceeded all other classes (49). The number of neonates found was not exceedingly high (40) and males were the least likely encountered (36). Females tend to be more frequently caught than males in this species, and Zamudio (1997, 1998) attributes such biases to differences in escape behaviour and thermoregulatory requirements between the sexes. Females tend to return to similar home range sites annually, while no such affinity has been noted in males (Powell and Russell 1994, 1996b). Males appear to have much larger home ranges, and may disperse over relatively long distances over the course of a single active season. As well, males seem to occasionally occur in more irregular habitat, perhaps as a function of this wider range. Males may actually be less numerous in the population, as they are likely exposed to greater predation risk while moving through larger, less familiar ranges.

The relatively low proportion of neonates detected at some sites is surprising, given the timing and intensity of the search. Possible explanations could include simply not detecting them – they are similar in size to grasshoppers (also numerous at some locations) – and low neonate numbers overall, given the extreme drought conditions. The productivity of the entire ecosystem has been inhibited by the lack of precipitation, and the lower levels of output may reduce prey availability and consequently reproductive success in horned lizards. Conversely, there is the possibility that some aspects of the dry conditions are favourable for

lizards, perhaps reducing competition and predation, and providing ample warm weather to facilitate reproduction and successful overwintering. However, it is expected that prey populations (arthropods) are likely to be negatively affected by the reduced overall productivity and that this may in turn be reflected in the low neonate numbers encountered this summer.

6.0 MANGEMENT IMPLICATIONS AND FUTURE DIRECTIONS

Surveys of presence/absence are useful for determining population persistence and gauging, in a very general manner, the status of species that may be at risk and their habitats. By endeavoring to maintain repeated survey efforts, the probability of detecting changes in population status is much improved. Without continued survey efforts, the status of this species would be very difficult to determine, as they are not widely known, are challenging to find, and have relatively short life spans.

A more realistic survey technique, if meaningful population trend data is sought, would be to choose a few well-populated sites and to initiate a long-term monitoring study. Permanently marking animals (i.e. toe-clips, sub-cutaneous bar code chips, etc.) would help identify individuals from year to year, which would enhance data value. The availability of GPS units would make annually returning to, and surveying, the same areas relatively straightforward. This could be augmented with once-per-decade site checks at outlying, less densely populated sites. Such a project need not be expensive, nor terribly time-consuming, just repeatable and consistent. It is strongly suggested that the same individuals be responsible for the survey for an extended period of time to enhance replication accuracy and the expectations that landowners have of confidentiality. Additionally, efforts to delineate potential habitat areas via satellite imaging and to consider cumulative effects would be beneficial, since the habitat is restricted in type and limited in area within the province. As well, it happens to coincide with a great deal of oil and gas activity in some portions of the range – and monitoring of this potential interaction would be informative.

The following are some suggestions for future search efforts to keep in mind. It would be prudent to procure and use accommodations (campers/trailers/rental units) that are relatively close by sites if possible. Driving for long distances every day wastes valuable time and fuel, and adds to the expense. Updated, more detailed survey forms, including more information about habitat details and capture locations should be created and used. Ensuring that forms are completely filled out and all data is collected is critical. Making certain that searchers mark their searched area(s) and the approximate location of captures on paper maps, and/or air photos is also important. Alternatively, they could maintain a GPS record of their survey trail and plot it on a digitally derived map of the area immediately following each search. In either case, it is important that the area searched be thoroughly documented for future reference.

It is suggested that a complete survey of all remaining locations be finished over the field season of 2002, with the information compiled to make an up-to-date list of potential population locations. Some of the historical sites searched in 2001 currently lack suitable habitat due to ongoing habitat loss and fragmentation and should be removed from the list of

populated sites. It is important that each potential location be visited and evaluated for this reason. It is also strongly recommended that the remaining locations be visited and evaluated, so that ultimately a comprehensive and up-to-date list of land locations may be completed. This would provide a concrete basis from which future surveys could be conducted. Once a current list of valid population sites has been solidified, the ongoing monitoring of population trend could occur on a much smaller scale, with selected locations receiving brief annual surveys. Such surveys could provide the long-term information that would aid in obtaining a reasonable evaluation of population trends and therefore a more accurate status assessment for this species.

With this in mind, an additional, and highly significant, concern revolves around the data available from the provincial BSOD database. Some capture locations reported in BSOD have apparently been incorrectly recorded, or are hazed so much as to be misleading, even to those with access to this "confidential" information. Since several BSOD data points appear questionable, this pollutes the entire BSOD data collection for this species, as it is impossible to determine which locations are accurate and which are not without resorting to source information. This is a fundamental concern because it increases the total number of sections of land the species is found on, perhaps artificially inflating distribution, and in any case, complicating the search effort enormously. Consequently, it is highly recommended that any potential error in this source be immediately identified and resolved prior to completing the 2002 survey. This concern over the validity of some of the BSOD listed localities requires that the entire list of locations for this species be redefined from primary sources. This task is outside the scope of the current endeavor, so for the purposes of this report, all land locations listed in BSOD, as well as those in the more traditional sources, will be considered potential lizard population locations. The final list of sites to be searched in 2002 will rely on this finalized information.

The survey of Short-horned lizard populations carried out in the field season of 2001 provided some interesting results. The information gained from this years' survey has supplied significant insight into the status of the species over much of its range within Alberta. Populations in general seem stable, but no captures at all were made at some previously significant sites, which is of concern. Neonate captures were lower than expected; this could reflect the impact of drought on the species. As well, several potential sites were not searched this summer, due to constraints of time and manpower.

The objectives of this survey were to search all historical locations of Short-horned lizard populations within the province. By visiting each site, it was anticipated that an assessment of the available habitat could be made, and verification of the presence of the species at each site made. As many sites as possible were searched within the time frame allotted; however, not all locations were visited. Within the sites searched, 125 captures were made, and information was collected on the available habitat. The tasks remaining are to resolve inconsistencies in the final list of population locations and to search those remaining sites in July and August of 2002.

7.0 LITERATURE CITED AND OTHER REFERENCES

Achuff, P.I. 1992. Natural Regions, Subregions and Natural History Themes of Alberta: A classification for protected areas management. Report No. 2 Prepared for Parks Services and Natural and Protected Areas, Alberta Government. Revised and updated December 1994.

Alberta Environment. 1999. Alberta Natural Region Land Classification System Document. [Online] Available http//:www3.gov.ab.ca/env/parks/anhic/drymxgrs.html (5 Nov 2001)

Alberta Environmental Protection (AEP). 1997. The Grassland Natural Region of Alberta. Natural Resources Service, Recreation and Protected Areas Division, Natural Heritage Protection and Education Branch.

Alberta Fish and Wildlife. 1991. The Status of Alberta Wildlife. Pub. No. I/413. Alberta Forestry, Lands and Wildlife. Fish and Wildlife Division, Edmonton, Alberta. 49 pp.

Alberta Fish and Wildlife. 1985. A Policy for the Management of Threatened Wildlife in Alberta. Alberta Natural Resources. Fish and Wildlife Division. Edmonton. Alberta Fish and Wildlife 1984

Alberta Fish and Wildlife. 1984. Status of the Fish and Wildlife Resource in Alberta. Alberta Energy and Natural Resources. Fish and Wildlife Division. Edmonton, AB.

Alberta Natural Heritage Information Centre (ANHIC). 2000. Reptile Tracking List. [Online] Available http://www3.gov.ab.ca/env/parks/anhic/reptrack.html (5 Nov 2001).

Alberta Sustainable Resource Development (ABSRD). 2001. Recommended guideline for protection of selected wildlife species and habitat within grassland and parkland natural regions of Alberta. Draft. July 31 version. Fish and Wildlife Division. Edmonton, AB 5 pp.

Alberta Wildlife Management Division. 1996. The Status of Alberta Wildlife. Pub. No. I/620. Alberta Environmental Protection. Natural Resources Service, Edmonton, AB. 44 pp.

Anonymous. 2001. Environment Canada, Green Lane. Summer regional precipitation departures, driest ten years in the period 1948- 2001 [Online] Available: http://www.msc-smc.ec.gc.ca/ccrm/bulletin/ptabrgdr.html (December 3, 2001)

Anonymous. 2000. The general status of Alberta wild species. Alberta Environment / Alberta Sustainable Resource Development. Edmonton, AB. 46 pp.

Anonymous. 1994. Endangered Species in Canada (and other wildlife at risk). List of species at risk in Canada as determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). World Wildlife Fund Canada.

Anonymous. 1993. Environment Canada, Atmospheric Service. Canadian Climate Normals 1961-1990. Prairie Provinces. Canadian Climate Program. Catalogue No. En56-61/2-1993.

Beauchamp, B. B. Wone, S. Bros, and M. Kutilek. 1998. Habitat use of the Flat-tailed horned lizard (*Phrynosoma mcallii*) in a disturbed environment. J. Herpetol. 32(3):210-216.

Conant, R. 1975. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. Second edition. The Peterson Field Guide Series, 12. Houghton-Mifflin Co., Boston.

Crowther, B. I. (ed.) 2000. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. SSAR Herpetological Circular No. 29.

Fair, W. S. and S. E. Henke. 1997. Effects of habitat manipulations on Texas horned lizards and their prey. J. Wildl. Manage. 61(4):1366-1370.

James, J. D. 1997. Pre- and post-parturition thermoregulation in free-ranging female Eastern Short-horned lizards (*Phrynosoma douglassii brevirostre*) in southeastern Alberta. Unpublished Masters thesis. University of Calgary, Calgary, AB. 179 pp.

James, J. D., G. L. Powell, and A. P. Russell. 1997. Status of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 5, Edmonton, AB. 20 pp.

Laird, M. and R. Leech. 1980. Observations of the Short-horned lizard in southeastern Alberta. Blue Jay. 39(4):214-218.

Montanucci, R. R. 1981. Habitat separation between *Phrynosoma douglassii* and *P. orbiculare* (Lacertilia: Iguanidae) in Mexico. Copeia 1981: 147-153.

Pianka, E.R. and W.S. Parker. 1975. Ecology of horned lizards: a review with special reference to *Phrynosoma platyrhinos*. Copeia 1975(1):141-162.

Powell, G.L. 1982. The Eastern Short-horned lizard in Alberta: Basic field ecology of northern marginal populations. Unpublished Master's thesis. University of Calgary. Calgary, AB. 343 pp.

Powell, G.L. and A.P. Russell. 1984. The diet of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*) in Alberta and its relationship to sexual size dimorphism. Can. J. Zool. 62: 428-440.

Powell, G.L. and A.P. Russell. 1985a. Field thermal ecology of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*) in southeastern Alberta. Can. J. Zool. 63: 228-238.

Powell, G.L. and A.P. Russell. 1985b. Growth and sexual size dimorphism in Alberta populations of the Eastern Short-horned lizard, *Phrynosoma douglassi brevirostre*. Can. J. Zool. 63: 139-154.

Powell, G.L. and A.P. Russell. 1991a. Parturition and clutch size characteristics of Short-horned lizards (*Phrynosoma douglassii brevirostre*) from Alberta. Can. J. Zool. 69: 2759-2764.

Powell, G.L. and A.P. Russell. 1991b. Distribution of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*) in Alberta, Canada. Northwestern Naturalist. 72(1): 21-26.

Powell, G.L. and A.P. Russell. 1991c. Report on the 1991 search for the Pygmy Short-horned lizard (*Phrynosoma douglassii douglassii*) in the region of Osoyoos, British Columbia. The Wildlife Branch, B.C. Environment. 27 pp.

Powell, G.L. and A.P. Russell. 1992a. A preliminary survey of the distribution and abundance of the Eastern Short-horned Lizard (*Phrynosoma douglassii brevirostre*) in Alberta. A Report to The Recreation, Parks and Wildlife Foundation, Edmonton, AB. 135 pp.

Powell, G.L. and A. P. Russell. 1992b. The status of the Short-horned lizard (*Phrynosoma douglassii*) in Canada. Report to the Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. 22 pp.

Powell, G.L. and A.P. Russell. 1993a. The range and status of the Eastern Short-horned lizard in the Canadian prairies. pp. 278-290. *In:* G.L. Holroyd, H.L. Dickson, M. Regnier and H.C. Smith, *Eds*. Proceedings of the 3rd Prairie Conservation and Endangered Species Workshop. Provincial Museum of Alberta and Alberta Community Development.

Powell, G.L. and A.P. Russell. 1993b. A radiotelemetric study of movement and thermal ecology in an Alberta population of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*). Report to Alberta Forestry, Lands and Wildlife, Fish and Wildlife Division, Lethbridge, AB. 74 pp.

Powell, G.L. and A.P. Russell. 1994. A radiotelemetric study of movement, thermal ecology and hibernation site selection in an Albertan population of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*). Report to Alberta Environmental Protection, Fish and Wildlife Division, Lethbridge, AB. 132 pp.

Powell, G.L. and A.P. Russell. 1996a. Alberta's amphibians and reptiles: current research and conservation issues. *In*: W.D. Willms and J.F. Dormaar, *Eds*. Natural History Occasional Paper No. 23., Proceedings of the Fourth Prairie Conservation and Endangered Species Workshop. The Provincial Museum of Alberta and Alberta Community Development, Edmonton, AB. 337 pp.

Powell, G.L. and A.P. Russell. 1996b. Movement, thermal ecology, seasonal activity, and overwintering behaviour in an Alberta population of the Eastern Short-horned lizard (*Phrynosoma douglassii brevirostre*). Alberta Environmental Protection, Fish and Wildlife Division, Lethbridge, Alberta. 128 pp.

Powell, G.L. and A.P. Russell. 1996c. Short-horned lizards (*Phrynosoma douglassii brevirostre*) in Grasslands National Park. A report on the 1995 field season. Grasslands National Park, Parks Canada, Val Marie, SK. 74 pp.

Powell, G. L. and A. P. Russell. 1998. The status of Short-horned lizards, *Phrynosoma douglasi* and *P. hernandezi*, in Canada. Can. Field Nat. 112(1): 1-16.

Powell, G.L., A.P. Russell, and P. Fargey. 1997. The distribution of the Eastern Short-horned lizard (*Phyrnosoma douglassii brevirostre*) in Saskatchewan, Canada. Grasslands National Park, Parks Canada, Val Marie, SK. 19 pp.

Reeve, W.L. 1952. Taxonomy and distribution of the horned lizard genus *Phrynosoma*. Univ. Kans. Sci. Bull. 34: 817-960.

Russell, A.P. and A.M. Bauer. 1993. The Amphibians and Reptiles of Alberta. University of Calgary and University of Alberta Presses. AB. 264 pp.

Russell, A.P. and A.M. Bauer. 2000. The Amphibians and Reptiles of Alberta. University of Calgary Press. Calgary, AB. 279 pp.

Sherbrooke, W.C. 1981. Horned lizards, Unique Reptiles of Western North America. E. Jackson, Editor. Southwest Parks and Monuments Association. Globe, AZ. 48 pp.

Sherbrooke, W.C. 1991. Behavioral (predator-prey) interactions of captive grasshopper mice (*Onchomys torridus*) and horned lizards (*Phrynosoma cornutum* and *P. modestum*). Am. Midl. Nat. 126: 187-195.

Smith, H. M., K. Adler, D. Chiszar and F. van Breukelen. 1999. *Phrynosoma hernandesi*: correct spelling. Herpetol. Rev. 30: 74-76.

Stebbins, R.C. 1985. A Field Guide to Western Reptiles and Amphibians. The Peterson Field Guide Series. Second Edition. Houghton Mifflin Co., Boston. 336 pp

Suarez, A. V., J. Q. Richmond, and T. J. Case. 2000. Prey selection in horned lizards following the invasion of Argentine ants in southern California. Ecol. Applications 10(3):711-725.

Thompson, W. L., G.C. White, and C. Gowan. 1998. Monitoring vertebrate populations. Academic Press, Inc. Toronto. 365 pp.

Zamudio, K. R., K. B. Jones and R. H. Ward. 1997. Molecular systematics of Short-horned lizards: biogeography and taxonomy of a widespread species complex. Syst. Biol. 46(2): 284-305.

APPENDIX A: INDUSTRIAL PROTOCOL SUGGESTIONS

Several requests have been made for general guidelines that would enable industrial companies, particularly oil and gas interests, to search an area for Short-horned lizards in compliance with Environmental Impact Assessment requirements. The following is a list of recommendations for searching for lizards on a property.

1. Use experienced / trained field biologists to check for species presence.
Short-horned lizards are extremely difficult to locate and suitable habitats are often challenging to differentiate from surrounding areas. Although novice searchers will often find lizards on outings they may attend with more experienced searchers, knowing where to look and what to look for in the first place are key. The most effective searchers are likely to be those who are experienced in the search technique and the habitat types frequented by the species in the different areas they are found. Additionally, experienced searchers may already be known to the landowners and less likely to arouse concern.

2. Time the search for optimal population levels.
Short-horned lizard population numbers increase sharply after the young are born in late July or early August. Although this does not guarantee search success, it is thought to improve the probability significantly.

3. Recognize they may use a wide range of habitat within the location.
It must be recognized that female lizards may have relatively small summer home ranges, but they may also shift home range areas repeatedly over the course of the active period. As well, it does not appear that hibernation areas are generally within the summer home range areas. Overwintering areas may be some distance (perhaps up to 1km?) from the summer home range area. Males appear to have broad home ranges, and may move considerable distances, making them generally less predictable to find than females.

4. Recognize that the documented range of the species is likely to be incomplete within the province. Terrain near to existing sites may also hold previously undocumented populations of this species. This is especially true if the area contains suitable habitat. It is **suggested that suitable habitat on land locations within 10 km surrounding known locations should also be searched** for undocumented populations. Land locations between significant populations, such as those along the South Saskatchewan River, should also be searched. As with many herptiles, Short-horned lizards are small and cryptic, and therefore their presence is not as widely known as with some larger, more conspicuous species. Their presence may be easily overlooked by inexperienced biologists.

5. Plan to spend between one and three days of appropriate weather searching a location.
Experienced searchers have found that it takes approximately three hours of searching, under appropriate conditions, per lizard capture made. Of course, this may vary significantly among sites. Sites at the northern margin of the species range seem to be less densely populated and consequently it may take much longer to successfully find even a single

animal. Weather can be critical in search success because of its effect on lizard activity (see the following).

6. Be aware of the effect of time of day and w eather conditions on lizard activity. Short-horned lizards are ectothermic reptiles. They remain completely inactive in periods of cool, wet weather, rendering them impossible to find. Thermoregulatory activity begins shortly after sunrise and may continue, in some manner, until sunset or later. They are less affected by windy conditions, or light clouds, but heavy cloud cover may cause them to seek cover for the day and become inactive. Cool temperatures are not as significant as heavy cloud cover, as lizards may still manage to thermoregulate by basking.

APPENDIX B: SUGGESTIONS FOR INDUSTRIAL MITIGATION IN AREAS POTENTIALLY POPULATED WITH SHORT-HORNED LIZARDS

1. Avoid any damage to sparsely vegetated **south-facing slopes** at any time during the year.

2. Where industrial activity must occur in an area populated by Short-horned lizards, it is suggested that **any activity occur at least 20 m from coulee rims and on** the more densely vegetated, **northerly-facing slopes if it is necessary to travers e slopes** at all.

3. If individual animals happen to be found within an area of activity, **they should be moved** to an area some distance (100m +) from the activity where there are not likely to be disturbed again. Short-horned lizards are not speedy walkers, and, unlike snakes or birds, cannot easily escape when they sense a large disturbance moving their way. They do not bite, scratch or otherwise cause any harm to humans and are easily caught by hand. Once captured, they are remarkably docile. Keep in mind, however, that they will not survive in captivity.

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(as of December 2001)

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